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	L20	L18 and (111 or nrps)	38
	L19	L18 and (l2 or nrps)	136
	L18	L16 and ((112 or pks or nrps) same (start\$ or load\$))	136
	L17	L16 and (l12 same (start\$ or load\$))	101
	L16	L15 and hybrid	243
	L15	L14 and (start\$ or load\$)	316
	L14	L12 and 14	338
	L13	L12 and (start\$ or load\$)	472
	L12	L11 or 110	617
	L11	nonribosomal adj2 peptide adj2 (synthase or synthetase)	42
	L10	polyketide adj2 (synthetase or synthase)	609
	L9	L7 and hybrid	4649
	L8	L7 nad hybrid	193015
	L7	L6 and 15	7555
	L6	start\$ or load\$ same 13	1935562
	L5	L4 and 13	9493
	L4	rapamycin or rifamycin or yersiniabactin or mycobactin or myxothiazol or epothilone or microcystin or fk520 or bleomycin	14210
Ó	L3	L2 or 11	182098
Ò	L2	nonribosomal (2w) peptide (2w) (synthase or synthetase)	181947
	L1-	polyketide (2w) (synthase or synthetase)	35121

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PI PRAI	WO 2003070908 A2 US 2003225006 A1 US 2002-358075P P	20031204	WO 2003-US4998 US 2003-368770	
L6 AN TI AU SO L6 AN TI	ANSWER 2 OF 21 CAPLUS 2003:573354 CAPLUS BlmIII and BlmIV Nonri Synthetase-Catalyzed B Bithiazole Moiety Invo Du, Liangcheng; Chen, Biochemistry (2003), 4 ANSWER 3 OF 21 CAPLUS 2002:965021 CAPLUS Biosynthesis of polyke PATENT NO. KIND	bosomal Peptide liosynthesis of lving Both in (Mei; Zhang, Yar 2(32), 9731-974	the Bleomycin Cis and in Trans Ang; Shen, Ben 10	minoacylation DATE
PI	US 2002192767 A1 US 2002045220 A1 US 2002142401 A1 US 1999-159090P P US 2000-206082P P US 2000-232379P P US 2000-687855 A2 US 2001-798033 A2 US 1999-161414P P US 1999-161703P P US 2000-699136 A3			20020228 20010228 20010829
L6 AN TI AU SO	ANSWER 4 OF 21 CAPLUS 2002:940403 CAPLUS Quantitative Analysis of Modular Polyketide Liou, Grace F.; Lau, J Biochemistry (2003), 4	of Loading and Synthases anice; Cane, Da	_	

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ΑN
     2002:676167 CAPLUS
     Biosynthesis of unusual substrates for polyketide
ΤI
     synthases and their use in the biosynthesis of novel polyketides
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                            20001013
     WO 2002-US6399
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     ANSWER 6 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
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     2002:561860 CAPLUS
     Skipping in a Hybrid Polyketide Synthase. Evidence for
     ACP-to-ACP Chain Transfer
ΑU
     Thomas, Iain; Martin, Christine J.; Wilkinson, Christopher J.; Staunton,
     James; Leadlay, Peter F.
SO
     Chemistry & Biology (2002), 9(7), 781-787
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     ANSWER 7 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
ΑN
     2002:294174 CAPLUS
TI
     Biosynthesis of polyketide synthase substrates
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     ANSWER $\forall OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
L6
     2002:26/7521 CAPLUS
ΑN
TΙ
     Engineering specificity of starter unit selection by the
     exythromycin-producing polyketide synthase
ΑU
     Long, Paul F.; Wilkinson, Christopher J.; Bisang, Christian P.; Cortes,
     Jesus; Dunster, Nicholas; Oliynyk, Marko; McCormick, Ellen; McArthur,
     Hamish; Mendez, Carmen; Salas, Jose A.; Staunton, James; Leadlay, Peter F.
SO
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- Nonribosomal biosynthesis of microbial chromopeptides TT
- Keller, Ullrich; Schauwecker, Florian ΑU
- SO Progress in Nucleic Acid Research and Molecular Biology (2001), 70, 233-289
- L6 ANSWER 10 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- 2001:686932 CAPLUS
 - sept. tro late Epothilone biosynthesis: assembly of the methylthiazolylcarboxy starter unit on the EpoB subunit
- Chen, H.; O'Connor, S.; Cane, D. E.; Walsh, C. T. ΑU
- Chemistry & Biology (2001), 8(9), 899-912 SO
- ANSWER 11 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN L6
- 2001:637137 CAPLUS ΑN
- TΙ Enzymatic assembly of hybrid polyketide/nonribosomal peptide natural products
- Walsh, C. T. ΑU
- Abstracts of Papers, 222nd ACS National Meeting, Chicago, IL, United SO States, August 26-30, 2001 (2001), BIOL-126 Publisher: American Chemical Society, Washington, D. C.
- DTConference; Meeting Abstract
- ANSWER, 12 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN L6
- 2001:232268 CAPLUS AN
- Yersiniabactin Synthetase: Probing the Recognition of Carrier TΙ Protein Domains by the Catalytic Heterocyclization Domains, Cy1 and Cy2, in the Chain-Initiating HMWP2 Subunit
- Mil/er Deborah Ann; Walsh, Christopher T. AU
- Biochemistry (2001), 40(17), 5313-5321 SO
- L6 ANSWER 13 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- 2001:51333 CAPLUS ΑN
- TΙ Mechanisms of molecular recognition in the pikromycin polyketide
- ΑU Chen, Shuo; Xue, Yongquan; Sherman, David H.; Reynolds, Kevin A.
- SO Chemistry & Biology (2000), 7(12), 907-918

- L6 ANSWER 14 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2000:368562 CAPLUS
- TT Epothilone and epothilone derivatives production based on recombinant nucleic acids encoding the epithilone polyketide synthase from Sorangium cellulosum

	PATENT NO.		KIND DATE		AP	PLICATION NO.	DATE	
ΡI	WO	2000031247	A2	20000602	WO	1999-US27438	19991119	
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	EP	1135470	A2	20010926	EΡ	1999-960500	19991119	
	JP	2002530107	T2	20020917	JΡ	2000-584057	19991119	
	AU	768220	B2	20031204	AU	2000-17377	19991119	
	US	6410301	B1	20020625	US	2000-560367	20000428	
	US	2003096381	A1	20030522	US	2002-191694	20020708	
PRAI	US	1998-109401P	P	19981120				
	US	1999-119386P	P	19990210				
	US	1999-122620P	P	19990303				
	US	1999-130560P	P	19990422				
	US	1999-443501	A2	19991119				
	WO	1999-US27438	W	19991119				
	US	2000-560367	A1	20000428				

- L6 ANSWER 15 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2000:94673 CAPLUS
- TI Selectivity of the Yersiniabactin Synthetase Adenylation Domain in the Two-Step Process of Amino Acid Activation and Transfer to a Holo-Carrier Protein Domain
- AU Keating, Thomas A.; Suo, Zucai; Ehmann, David E.; Walsh, Christopher T.
- SO Biochemistry (2000), 39(9), 2297-2306
- L6 ANSWER 16 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2000:88787 CAPLUS
- TI Cloning and heterologous expression of the epothilone gene cluster
- AU Tang, Li; Shah, Sanjay; Chung, Loleta; Carney, John; Katz, Leonard; Khosla, Chaitan; Julien, Bryan
- SO Science (Washington, D. C.) (2000), 287(5453), 640-642
- L6 ANSWER 17 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2000:15378 CAPLUS
- TI Functional domains of polyketide synthetases and their use in the generation of novel synthetases and novel macrolide antibiotics
- IN Leadlay, Peter Francis; Staunton, James; Cortes, Jesus; McArthur, Hamish Alastair Irvine
- SO PCT Int. Appl., 97 pp.

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	PAT	ENT NO.	KIND	DATE	APPLICATION NO.	DATE
						
PI	WO	2000000618	A2	20000106	WO 1999-GB2044	19990629
	WO	2000000618	A3	20000427		
	AU	9945247	A1	20000117	AU 1999-45247	19990629
	AU	763230	B2	20030717		
	BR	9911712	A	20010320	BR 1999-11712	19990629
	EΡ	1090123	A2 ·	20010411	EP 1999-928128	19990629
	JP	2002519032	T 2	20020702	JP 2000-557371	19990629
PRAI	GB	1998-14006	Α	19980629		
	WO	1999-GB2044	W	19990629		

- L6 ANSWER 18 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 1999:764178 CAPLUS
- TI Sequence and recombinant narbonolide polyketide synthase applications from Streptomyces venezuelae for creation of useful antibiotics

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE	
PI	WO 9961599	A2	19991202	WO 1999-US11814	19990527	
	WO 9961599 US 6503741	A3 B1	20000127 20030107		19980828	
	CA 2328427 AU 9942137	AA A1	19991202 19991213		19990527 19990527	
	AU 762399	B2	20030626	1000 00505		
	EP 1082439 JP 2002516090	A2 T2	20010314 20020604		19990527 19990527	
	NZ 509006	Α	20030926		19990527	
PRAT	AU 769288 US·1998-87080P	B2 P	20040122 19980528	AU 2001-57805	20010803	
LIMI	US 1998-141908	A	19980828			
	US 1998-100880P	P	19980922			
	US 1999-119139P AU 1998-71722	P A3	19990208 19980430			
	WO 1999-US11814	M	19990527	•		

- L6 ANSWER 19 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 1999:468634 CAPLUS
- TI Chimeric polyketide synthase gene assembly construct and its use in the synthesis of novel polyketides
- IN Leadlay, Peter Francis; Staunton, James; Wilkinson, Barrie; Rowe, Christine Janet; Bohm, Ines Ute; Buss, Antony David

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
ΡI	WO 9936546	A1	19990722	WO 1999-GB117	19990114
	CA 2318365	AA	19990722	CA 1999-2318365	19990114
	AU 9920667	A1	19990802	AU 1999-20667	19990114
	EP 1045912	A1	20001025	EP 1999-901036	19990114
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	HR 2000000474	A1	20001231	HR 2000-474	20000714
PRAI	GB 1998-675	A	19980114	•	
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	WO 1999-GB117	W	19990114		

- L6 ANSWER 20 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 1998:597032 CAPLUS

181

- TI Characterization of the enzymic domains in the modular polyketide synthase involved in rifamycin B biosynthesis by Amycolatopsis mediterranei
- AU Tang, Li; Yoon, Yeo J.; Choi, Cha-Yong; Hutchinson, C. Richard
- SO Gene (1998), 216(2), 255-265

- L6 ANSWER 21 OF 21 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 1998:66007 CAPLUS
- TI Manufacture of substituted erythromycins with transgenic Saccharopolyspora using a carboxylic acid-contg. medium
- IN Leadlay, Peter Francis; Staunton, James; Cortes, Jesus; Pacey, Michael Stephen

		PENT NO.	KIND	DATE	API	PLICATION NO.	DATE
ΡI	WO	9801571	A2	19980115	WO	1997-GB1810	19970704
	WO	9801571	A3	19980219			
	CA	2259420	AA	19980115	CA	1997-2259420	19970704
	CA	2259463	AA	19980115	CA	1997-2259463	19970704
•	AU	9734509	A1	19980202	AU	1997-34509	19970704
	ΑU	731301	B2	20010329			
	EΡ	909327	A2	19990421	EP	1997-930626	19970704
	GB	2331518	A1	19990526	GB	1999-156	19970704
		2331518	B2	20010314			
		1229438	A	19990922	CN	1997-197649	19970704
	BR	9710209	Α	20000111	BR	1997-10209	19970704
	NZ	333861	A	20000825	NZ	1997-333861	19970704
	JP	2000516450	T2	20001212	JP	1998-504925	19970704
		1029	A	20011211	AP	1999-1444	19970704
		3976	В1	20030217	EE	1999-14	19970704
		9854308	A2	19981203	WO	1998-GB1559	19980528
		9854308	A3	19990408			
	AU	9876661	A1	19981230	AU	1998-76661	19980528
	EΡ	983348	A2	20000308	EP	1998-924463	19980528
		9900012	A	19990223	NO	1999-12	19990104
		2000023579	A	20000425	KR	1999-700024	19990105
		6271255	В1	20010807	US	1999-214454	19990916
		2001016598	A1	20010823			
		2002004487	A1	20020110	US	2001-896357	20010629
		6437151	В2	20020820			
		2003104585	A1	20030605	US	2002-307595	20021202
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		1996-24188P	P	19960819			
		1997-10962	A	19970528			
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L1 AN TI	ANSWER 1 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN 2003:898258 CAPLUS Protein and DNA sequences of Streptomyces hydroscopicus 17997 gene clust for biosynthesis of geldanamycin									
	PATENT NO. KIND DATE APPLICATION NO. DATE									
PI PRA										
L1	ANSWER 2 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN									
AN TI	2003:827039 CAPLUS A Switch for the Transfer of Substrate between Nonribosomal Peptide and Polyketide Modules of the Rifamycin Synthetase Assembly Line									
AU SO	Admiraal, Suzanne J.; Khosla, Chaitan; Walsh, Christopher T.									
L1 AN										
TI	Understanding Substrate Specificity of Polyketide Synthase Modules by Generating Hybrid Multimodular Synthases									
AU	Watanabe, Kenji; Wang, Clay C. C.; Boddy, Christopher N.; Cane, David E.; Khosla, Chaitan									
SO	Journal of Biological Chemistry (2003), 278(43), 42020-42026									
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AU	Hong, Jay Sung Joong; Choi, Cha Yong; Yoon, Yeo Joon									
so	Journal of Microbiology and Biotechnology (2003), 13(4), 613-619									
L1	ANSWER 5 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN									
AN TI										
	Escherichia coli									
AU SO										
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TI IN	Biosynthesis of polyketide synthase substrates									

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- L1 ANSWER 7 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2002:676167 CAPLUS
- TI Biosynthesis of unusual substrates for polyketide synthases and their use in the biosynthesis of novel polyketides
- ΙN Khosla, Chaitan; Pfeifer, Blaine PATENT NO. KIND DATE APPLICATION NO. DATE ____ WO 2002068613 20020906 PIΑ1 WO 2002-US6399 20020228 US 2002045220 20020418 US 2001-798033 20010228 A1 EP. 1381672 Α1 20040121 EP 2002-725059 20020228 PRAI US 2001-798033 Α 20010228 US 2002-355211P Ρ 20020208 US 1999-159090P Р 19991013 US 2000-206082P Ρ 20000518 Ρ US 2000-232379P 20000914 US 2000-687855 .A2 20001013 WO 2002-US6399 W 20020228
- L1 ANSWER 8 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2002:237711 CAPLUS
- TI The Loading and Initial Elongation Modules of Rifamycin Synthetase Collaborate To Produce Mixed Aryl Ketide Products
- AU Admiraal, Suzanne J.; Khosla, Chaitan; Walsh, Christopher T.
- SO Biochemistry (2002), 41(16), 5313-5324
- L1 ANSWER 9 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2002:73807 CAPLUS
- TI Expression and Purification of the Rifamycin Amide Synthase, Riff, an Enzyme Homologous to the Prokaryotic Arylamine N-Acetyltransferases
- AU Pompeo, Frederique; Mushtaq, Adeel; Sim, Edith
- SO Protein Expression and Purification (2002), 24(1), 138-151
- L1 ANSWER 10 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2001:890104 CAPLUS
- TI Cloning and partial characterization of the putative rifamycin biosynthetic gene cluster from the actinomycete Amycolatopsis mediterranei DSM 46095
- AU Kaur, Hardeep; Cortes, Jesus; Leadlay, Peter; Lal, Rup
- SO Microbiological Research (2001), 156(3), 239-246

- L1ANSWER 11 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2001:761734 CAPLUS
- ΤI Antibiotic biosynthesis: From natural to unnatural compounds
- AU Floss, H. G.
- SO Journal of Industrial Microbiology & Biotechnology (2001), 27(3), 183-194
- L1ANSWER 12 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- 2001:279758 CAPLUS AN
- ΤI The Loading Module of Rifamycin Synthetase Is an Adenylation-Thiolation Didomain with Substrate Tolerance for Substituted Benzoates
- Admiraal, Suzanne J.; Walsh, Christopher T.; Khosla, Chaitan ΑU
- Biochemistry (2001), 40(20), 6116-6123 SO
- ANSWER 13 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN L1
- 2000:573921 CAPLUS ΑN
- TΙ Linker peptides for connecting modules of polyketide synthase and use of recombinant enzymes for preparing novel polyketides
- Gokhale, Rajesh S.; Tsuji, Stuart Y.; Khosla, Chaitan IN

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	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2000047724	A2	20000817	WO 2000-US3345	20000209
	WO 2000047724	A 3	20001207		
	CA 2359801	AA	20000817	CA 2000-2359801	20000209
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	JP 2002536014	Т2	20021029	JP 2000-598624	20000209
PRAI	US 1999-119363P	P	19990209		
	WO 2000-US3345	W	20000209		

- L1ANSWER 14 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN
- 2000:373084 CAPLUS
 Thioesterases and the premature termination of polyketide chain elongation TΙ C in ri-famycin B biosynthesis by Amycolatopsis mediterranei S699
- ΑU Doi-Katayama, Yukiko; Yoon, Yeo Joon; Choi, Cha-Yong; Yu, Tin-Wein; Floss, Heipz G.; Hutchinson, C. Richard
- Journal of Antibiotics (2000), 53(5), 484-495 SO
- L1ANSWER 15 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- 2000:34992 CAPLUS ΑN
- ΤI Methods for making polyketides by replacement of ketosynthase and aminotransferase domains in polyketide synthases
- ΙN Khosla, Chaitan; Lau, Janice; Pohl, Nicola L.

	PATENT N	0.	KIND	DATE	AF	PLICATION NO.	DATE
ΡI	WO 20000	01838	A2	20000113	WC	1999-US15047	19990702
	WO 20000	01838	A3	20001116			
	CA 23416	40	AA	20000113	CP	1999-2341640	19990702
	AU 99496	71	A1	20000124	ΑU	1999-49671	19990702
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	US 62216	41	B1	20010424	US	1999-346860	19990702
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US 2000-735685 A1 20001212
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OS MARPAT 132:90053

- L1 ANSWER 16 OF 28 CAPLUS COPYRIGHT 2004 ACS on STN
- AN 2000:34981 CAPLUS
- TI Fusion proteins of polyketide synthase functional domains and their use in the generation of novel polyketides
- IN Kellenberger, Johannes Laurenz; Leadlay, Peter Francis; Staunton, James; Stutzman-Engwall, Kim Jonelle; McArthur, Hamish Alastair Irvine
- PA Biotica Technology Limited, UK; Pfizer Inc.
- SO PCT Int. Appl., 76 pp.

50		PATENT NO.		KIND	DATE		PLICATION NO.	DATE	
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